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METROPOLITAN LIFE INSURANCE COMPANY

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We Outlive Our Expectation of Life

IN EVERYDAY speech the term "expectation of life" is not always used in its exact sense. Strictly speaking, the expectation of life at any age is the *prospective* average number of years of life remaining to persons of that age, provided that the death rates at each age remained constant at their prevailing levels. Thus, if we say that the expectation of life for a white male 10 years old in 1940 was 57 years, we mean that the members of the large group of boys of age 10 in that year would, on an average, survive 57 years, if the death rates at each age of life remained unchanged as of 1940. *Retrospectively*, of course, we know that the death rates at the younger and middle ages of life have declined materially in past years, and presumably will continue to decline for some time to come, so that the basic assumption of a constant death rate in the computation of the expectation of life does not correspond to the actual facts. Because of the improvements that have taken place since 1940, and that presumably will still take place, boys of age 10 in that year actually will, in all probability, outlive their expectation of life of 57 years, as computed on the basis of the mortality of 1940.

The true measure of the longevity of a generation can naturally be computed only after the generation has passed out, though it may be closely approximated if those surviving have reached a fairly advanced age, since it is the common experience that at the higher ages they presumably will gather little further advantage in the way of declining mortality. To illustrate these points, the actual average length of life of persons born in England and Wales in 1876 was compared with their prospective expectation of life at birth, computed according to the mortality conditions prevailing at that time. In carrying out the computation up to 1931, when these persons became 55 years of age,* a series of appropriate life tables, representing as nearly as possible the mortality prevailing through successive calendar years, was applied. Beyond 1931—that is, for the higher ages of this group of persons—the mortality rates were assumed to remain as of

*Details regarding the computation will be found in "Current versus Generation Life Tables" by Louis I. Dublin and Mortimer Spiegelman, published in *Human Biology*, volume 13, page 439, December 1941.

1931, since no more recent English data were available. This use of a constant life table at these higher ages is sufficiently accurate, because in these ranges of life there has been very little change in mortality in recent years.

Proceeding in the manner just outlined, it is found that for the generation of males born in England and Wales in 1876 the average length of life is 46.3 years; and for the generation of females, it is 50.6 years. These figures are to be compared with the expectation of life at birth corresponding to mortality conditions in 1876—namely, 41.4 years for males and 44.6 years for females. Thus, according to this example, the expectation of life fell short, as a measure of actual longevity, by 4.9 years in the case of males, and 6 years for females. Although differences of this magnitude are hardly to be found for more recent generations, some difference will exist as long as mortality continues to improve. In any event, it can safely be said that, with the present outlook for continuing improvement in mortality, the expectation of life at birth, as commonly computed, is a conservative measure of the longevity of a generation.

The improvement in mortality among generations born within our era of progress in public health, over that prevailing in their year of birth, has been accompanied by a considerable saving in lives. The facts for the generation of babies born in England and Wales in 1876 provide a striking example, as shown in the chart on page 3. By the time the generation had attained age 20 in 1896, almost 3 percent of the survivors owed their survival to the improvement in mortality since the year of their birth. The same circumstance accounted for practically one eighth of the survivors to age 45 in 1921 and one fifth of those reaching age 55 in 1931. Almost one third of the generation who attained age 65 in 1941 would not have been living if the mortality conditions of 1876 had continued without change. Since mortality conditions in England and Wales are not far different from those in the United States, the situations just described approximate closely those in our own country.

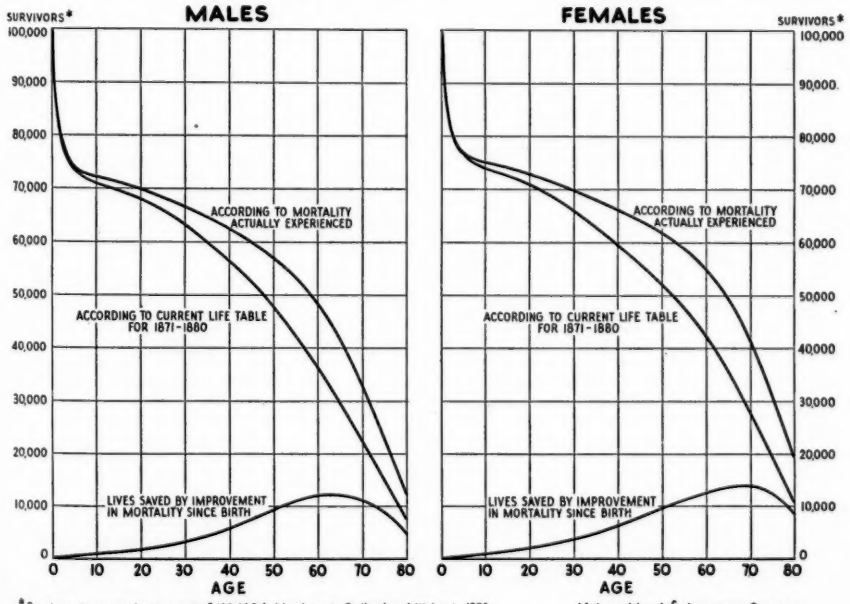
The savings in lives by the improvement in mortality during our era of health progress are impressive. To cite an example, we have in the United States today about 900,000 persons at the age of 65. Out of this total, 300,000 owe their existence to the advances of science and the standards of living that have aided in the reduction in mortality since their birth. Another example has an important relation to our national defense. Of the 26,500,000 men of ages 20 to 44 who have so far registered for military service, or are already so engaged, 2,900,000 must be credited to improvement in mortality since 1900. There are many among us who can definitely ascribe their existence today to some modern medical or surgical therapy at a critical moment in their life. But there are very many more whom

science has aided more indirectly by raising the standards of living and by spreading widely the benefits of sound public health practice.

The situation observed in the past, with actual survival exceeding expectation, can hardly continue indefinitely. As the average length of life has increased from year to year, further gains have become more and more difficult. Undoubtedly the time will come when we must expect an essentially stationary mortality condition. But as yet there is still room for improvement. Application always lags behind the acquisition of new knowledge, and the most recent advances in medicine have not yet had time to spread through the medical fraternity for actual practice. Though for the time being our efforts to spread the use of the best modern knowledge must take a second place, as compared with our war effort, the health of the Nation, to say nothing of the health of our armed forces, as well as our plans for postwar reconstruction, demand that there should be no diminution in our efforts to exploit to the limit modern medical and sanitary knowledge and technique.

In the meantime, as past wars have brought their own advances in surgery and medicine, we may expect again to draw some similar advantages from the terrible profit and loss account of the present conflict.

COMPARISON OF SURVIVORSHIP IN A *GENERATION* LIFE TABLE AND IN A *CURRENT* LIFE TABLE



*Survivors to successive ages out of 100,000 babies born in England and Wales in 1876.

Metropolitan Life Insurance Company

Accidental Shooting Fatalities in Wartime

FIREARMS stand out more prominently in the list of important causes of fatal accidents among civilians in wartime than they do in ordinary years. This is not because of any increase in the number of such deaths in these times—there are no grounds for believing that we shall have an inordinate number this year. They assume greater prominence because we associate this mode of death with war, and it comes to us as a shock to discover that so many persons die of bullet wounds accidentally inflicted by themselves or by others. Sixth in importance as a cause of fatal injury, shooting accidents in recent years have taken an average of 2,500 lives annually in the United States. The toll since the Armistice in November 1918 has reached almost 70,000 lives, almost 20,000 more than the fatalities in the A.E.F. in action or from wounds.

Our country will inevitably suffer the loss of many precious lives by enemy gunfire. That we shall lose many additional lives through rank carelessness is deplorable. Every effort should be made to reduce this needless wastage of life through accidental shooting of civilians. With the approach of the hunting season this fall, it is urgent that steps be taken in this direction, for past experience has shown that hunting is responsible for about one third of all fatal accidental shootings. Despite some wartime restriction on securing new weapons or ammunition, and other obstacles arising from the present war situation, millions of men and boys will nevertheless go hunting this year.

Mortality statistics show that deaths from shooting are particularly frequent among boys and young men. Males are the victims about seven times as frequently as females. In the three-year period 1937-1939, the latest years for which detailed data are available for the United States, the death rate was 3.2 per 100,000 white males, 0.4 per 100,000 white females, and 6.3 and 1.5 per 100,000 colored males and females, respectively.

The highest death rates among white males occur in late childhood and adolescence. Among white males 10 to 14 years, the rate was 4.5 deaths per 100,000; at ages 15 to 19, it was 7.0, the highest rate for any group of white persons. These are the ages at which boys are fascinated by firearms. Too often they are allowed to handle guns and to go on hunting trips without supervision before they have been carefully schooled in the use and care of guns or in the technique of hunting. However, hunting accidents figure prominently in the death toll at the older ages also among males.

An analysis made a few years ago of records of fatalities in hunting accidents among Industrial policyholders of the Metropolitan Life Insurance Company, showed that accidental discharge of the gun was the most frequently reported cause

of injury. Many reasons were given for mishaps of this kind, among which the more important were: striking the gun against the ground or other object when the hunter slipped, stumbled, or fell; carrying loaded guns while climbing over or through a fence; pulling loaded guns, muzzle first, through a fence; lifting loaded guns from automobiles, canoes, or other vehicles; becoming entangled in thick brush. In some cases the accident was due to a faulty gun. Not a few hunters were killed when they stepped into the line of fire of another's gun or were mistaken for deer or smaller game by other hunters.

Guns carelessly handled around the house take more lives even than are lost in hunting accidents. These accidents arise mainly in cleaning guns or pistols, in dropping the gun or knocking it off a support, exhibiting the "unloaded" gun, or in actual foolish play and scuffles. Even among youngsters under 10 years of age there are more than 200 fatalities due to firearm accidents each year. Guns carelessly left around the home where there are children invite tragedy. Far too frequently reports come in stating that a child found a gun in the home, and either he or a companion was killed while they played soldiers, cops and robbers, cowboys and Indians, etc.

It is enough that we must bear the shooting tragedies of war. Let us have fewer tragedies among our civilian population resulting from the gross carelessness which characterizes all accidental shootings.

Cancer and Tuberculosis—A Contrast

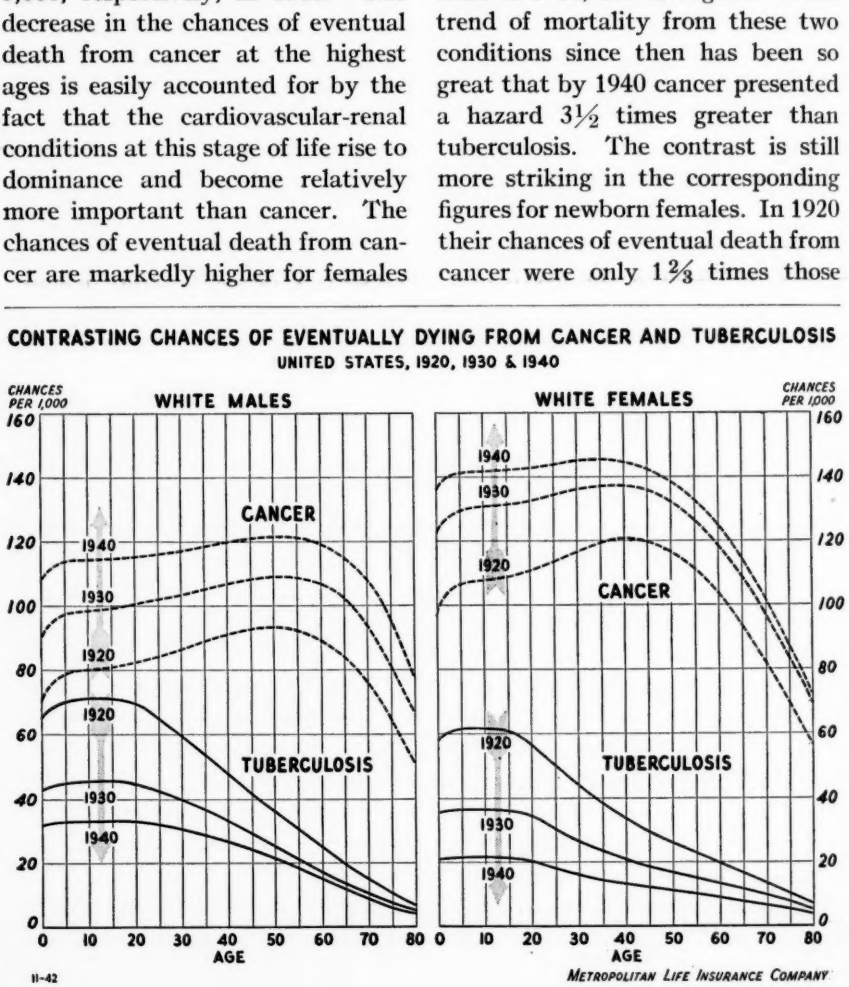
AN OUTSTANDING feature in the changing public health picture during the short period of the last two decades is the marked contrast that has taken place in the mortality from cancer and from tuberculosis. So great has been the reduction in the death rate from tuberculosis, that the chances of eventually dying from this disease according to present-day health standards are less than half those of only two decades ago. Thus, for the white male infant these chances decreased from 65 per 1,000 in 1920 to 32 per 1,000 in 1940, while for white female infants they dropped from 58 to 21 per 1,000. At the same time, the recorded mortality from cancer has increased to such an extent that, for the newborn child of today, the chances of eventual death from this condition are about 50 percent greater than they were 20 years ago. At the present time, these chances are about 108 per 1,000 for the newborn boy and 136 per 1,000 for the newborn girl. The chart on page 6 contains further details regarding the chances of eventual death from these two diseases according to health conditions in the general population of the United States in 1920, 1930, and 1940; the curves relate only to white persons.

Several interesting characteristics

are immediately apparent in the chart. The greatest probability of eventually dying from tuberculosis is found rather early in life, at about ages 5 to 15. The peak values in 1940 were about 33 per 1,000 for males and 21 per 1,000 for females. In the curves for cancer, the peaks come much later, at about age 50 for males and age 35 for females, with about 120 and 150 chances per 1,000, respectively, in 1940. The decrease in the chances of eventual death from cancer at the highest ages is easily accounted for by the fact that the cardiovascular-renal conditions at this stage of life rise to dominance and become relatively more important than cancer. The chances of eventual death from cancer are markedly higher for females than for males at all ages of life except for ages 65 and over in 1940; on the other hand, the risk of tuberculosis is the greater for males.

But the most striking feature in the comparison is a great change in the relative position of the two causes of death. Whereas, the chances of eventual death from cancer or from tuberculosis were practically equal for the newborn male of 1920, the divergence in the trend of mortality from these two conditions since then has been so great that by 1940 cancer presented a hazard 3½ times greater than tuberculosis. The contrast is still more striking in the corresponding figures for newborn females. In 1920 their chances of eventual death from cancer were only 1⅔ times those

CONTRASTING CHANCES OF EVENTUALLY DYING FROM CANCER AND TUBERCULOSIS
UNITED STATES, 1920, 1930 & 1940



from tuberculosis; by 1940 they were 6½ times as great.

Some of the increase in the chances of eventual death from cancer is a direct consequence of the improvement in our average length of life. Health conditions of today will permit a much larger proportion of persons than formerly to enter the older ages, where cancer mortality is at its highest. The situation is not so clear-cut in the case of tuberculosis. There the adolescent ages and the ages of early maturity loom large in the total death toll, because so few other diseases figure prominently at this period of life.

The contrast in the trends of mortality from tuberculosis and from cancer has great significance. In the reduction of the death rate from tuberculosis, we have a prime example of what has been done in the control of the infectious diseases by the rise in standards of living and the utilization of the discoveries and inventions of modern science. Curiously enough, these are the very factors which may in part account for our apparent setback in cancer mortality among males, to which reference was made in last month's issue of our STATISTICAL BULLETIN, and which, in themselves, tend to raise the chances of dying from the disease. By the development of new instruments and means of diagnosis, science has made it possible to find cases of cancer earlier and with more certainty. In addition, our rising standards of living include, as an integral element, greatly improved, better equipped, and more accessible hospital facilities for diagnosis.

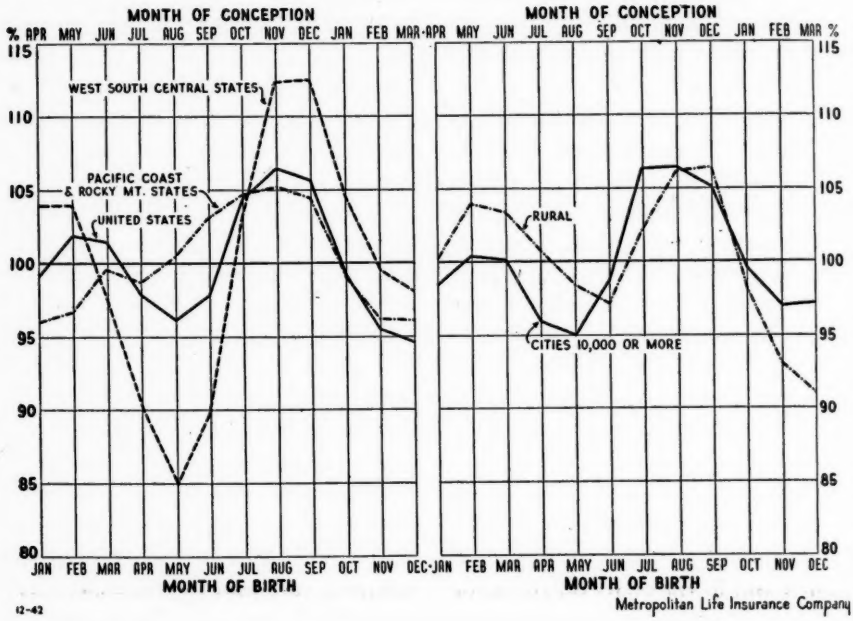
There is, however, one important point of similarity in cancer and tuberculosis. For both conditions, early discovery and treatment are essential to secure the best chances of a cure, as has been amply demonstrated by the many thousands of cases of recovery from tuberculosis and of cures from cancer. The number of such favorable results could be greatly augmented by careful periodic health examinations, which would bring to light cases of tuberculosis and cancer while treatment is most effective.

Births and Season of the Year

MORE American babies are born in July, August, and September than in any other three months of the year.

That there should be more or less pronounced seasonal variation in the birth rate is what one would naturally expect. Their general character in normal times can be followed in connection with the accompanying chart, based on the monthly births in the United States in the three years 1937-1939, a period undisturbed by such special conditions as those of the recent war years. The figures in the table and chart on page 8 are expressed in terms of the average daily births in the month, as a percentage of the average per day over the whole year.

SEASONAL DISTRIBUTION OF BIRTHS, UNITED STATES, 1937 TO 1939
DAILY AVERAGE IN MONTH AS PERCENT OF DAILY AVERAGE OVER PERIOD


MONTH OF CONCEPTION
% APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR
115
110
105
100
95
90
85
80
WEST SOUTH CENTRAL STATES
PACIFIC COAST & ROCKY MT. STATES
UNITED STATES
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
MONTH OF BIRTH
MONTH OF CONCEPTION
APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR %
RURAL
CITIES 10,000 OR MORE
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
MONTH OF BIRTH
12-42
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It is characteristic of all the curves shown, except one, that they exhibit two maxima and two minima in the course of the year. For the United States as a whole the first maximum comes in February and March, the second, much more pronounced, in August.

The figures for rural births show wider swings from the average than do those for urban areas. Thus, the drop from maximum to the succeed-

DAILY AVERAGE BIRTHS IN THE MONTH AS PERCENT OF DAILY AVERAGE IN THE PERIOD 1937–1939

GEOGRAPHIC DIVISION	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
UNITED STATES	99.2	101.8	101.4	97.8	96.2	97.8	104.4	106.5	105.7	99.2	95.5	94.6
Cities of 10,000 or more	98.4	100.3	100.1	95.9	95.0	98.7	106.3	106.4	105.1	99.6	97.0	97.2
Rural	100.2	104.0	103.3	100.7	98.3	97.1	102.2	106.2	106.3	98.2	93.0	90.9
New England and Middle Atlantic	97.5	100.7	102.2	100.4	98.6	101.4	107.1	104.6	102.2	96.9	94.2	94.1
North Central	99.1	101.8	101.4	95.7	95.8	98.6	106.0	107.6	105.3	98.9	95.4	94.4
South Atlantic and East South Central	100.1	104.0	103.1	100.6	97.4	95.1	100.6	104.9	107.0	99.3	94.9	93.4
West South Central	103.9	103.9	97.5	90.2	84.8	89.7	103.2	112.3	112.5	104.6	99.5	98.0
Pacific and Mountain	96.0	96.7	99.6	98.7	100.4	103.1	104.7	105.2	104.4	98.9	96.2	96.1

ing minimum is 15 percent in rural births as against 9 percent in urban births, and from the secondary maximum to the succeeding minimum, 7 percent and 5 percent, respectively. The period of the maximum number of births is about the same—namely, from July through September in both city and country—but the peak figure is reached in the cities in August, a month earlier than for rural births. With regard to the low point, there is a distinct difference in that the minimum figure of urban births occurs in May as against December in the country as a whole.

Sectional differences in seasonal distribution of births are quite marked, as shown in the table on page 8 and in the chart on the same page. The facts are presented for five broad geographic areas which analysis showed to be fairly homogeneous with respect to seasonal variation in births. Two sections particularly show marked deviations in seasonal births from the country as a whole. In the West South Central States, which include Texas and the adjoining States to the north and east, the curve of births has an extraordinarily large amplitude, and a very steep rise—over 20 percent—between June and August. In contrast, the seasonal curve of births in the Far West is notable for its relatively small amplitude and also for its relatively smooth character.

There is some evidence that the seasonal characteristics of births have, in recent years, been moderated. L. J. Reed demonstrated this in an analysis of births in Boston between 1900 and 1921. Data collected by Ellsworth Huntington for Massachusetts also showed this over a longer period and, moreover, gave evidence that in earlier decades the curve tended to have only a single peak, in autumn.

The factors underlying seasonal variations in births in normal times are many—social and economic, religious, climatic, and biological. To some extent, these factors are interrelated. In view of the differences of the character of the curves for different areas, it is obvious that the importance of each factor likewise varies from region to region. The first factor one naturally thinks of is the association between the marriage rate and births, especially first births. But while there is some parallelism between the seasonal curves of marriages and births, the parallelism is not very consistent and is of doubtful meaning.

Economic factors also influence the seasonal variation in births. This is most strongly marked in agricultural areas, and may be related to the strongly seasonal character of the periods of intensified work on the farm.

It has been suggested by many students of the subject that month to month variation in conceptions and births has a biological background and reflects, in very diluted form, the survival of a definite mating season in man. For lack of competent data, it is difficult to judge the soundness of this view.

However this may be, the factors

enumerated are such as may be expected to influence the seasonal flow of the birth curve in *normal* times. But ours are not normal times. War causes quite violent disruptions of the fairly regular seasonal pattern of births observed in peacetime, and the effects may extend for a considerable period after the close of hostilities. This is best seen in the data for European countries during and after the first World War. A particularly striking example of the complete upset of the seasonal pattern of births is seen in the records of the relative birth rates for successive months (expressed as percents of the average birth rate for the year) in Paris, France, in the years 1914, 1915, and 1919. The first of these three years, as shown in the table on this page may be taken as representing essentially the normal seasonal pattern for Paris, which is somewhat unlike our own. But the striking thing in this set of figures is the extraordinary contrasts such as, for instance, for the month of January, with a relative birth rate of 70.5 in 1919 as against 144.8 in 1915, and 107.1 in 1914. At the other end of the scale, for December, we see in 1919 a rate of 135.7, as against 81.6 in 1915 and 82.1 in 1914. German births during and after the first World War showed similarly wide departures from the normal pattern.

Naturally, because of the relatively short period of our participation in the first World War, there was not as profound an effect on the seasonal curve of births in this country as in Europe. Even so, there was some evidence of disturbance in that the usual downward trend of births in the last part of the year was accelerated in 1918, as the effect of the withdrawal of men of marriageable age from the civilian population. In the same period of the very next year, however, there was a sharp contra-seasonal rise, reflecting the return of the soldiers to civilian life. Our participation in the present war also is as yet of too short duration to affect the seasonal trend of births. However, the general expectation that we would eventually become involved was in itself enough to stimulate an increase both in marriages and births. As a result, the seasonal curve of births in 1940 and 1941, in New York State, shows appreciable changes from the norm, with the midsummer peak strongly accentuated.

LIVE BIRTHS, PARIS, FRANCE, 1914, 1915, AND 1919 COMPARED—DAILY AVERAGE BIRTHS IN THE MONTH AS PERCENT OF DAILY AVERAGE IN THE YEAR SPECIFIED.

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1914	107.1	114.1	112.9	113.7	108.3	110.1	102.6	100.1	86.8	79.6	83.8	82.1
1915	144.8	152.4	152.3	143.0	81.9	67.0	72.2	74.9	78.7	78.4	76.7	81.6
1919	70.5	88.4	76.9	87.2	94.3	86.8	86.7	95.6	117.8	127.7	132.1	135.7

Comparative Data on the Causes of Death Among Industrial Policyholders

The following table shows the mortality among Industrial policyholders for July 1942 and July 1941, together with the death rates for the first seven months of 1942, 1941, and 1940.

DEATH RATES* PER 100,000 POLICYHOLDERS FROM SELECTED CAUSES. WEEKLY PREMIUM-PAYING INDUSTRIAL BUSINESS — METROPOLITAN LIFE INSURANCE COMPANY

CAUSES OF DEATH	ANNUAL RATE PER 100,000 POLICYHOLDERS*				
	July 1942	July 1941	Year to Date: End of July		
			1942	1941	1940
ALL CAUSES—TOTAL	687.5	713.6	755.8	782.8	789.2
Typhoid fever	0.5	0.5	0.3	0.5	0.5
Measles	.5	.5	.7	1.2	.4
Scarlet fever	.3	.3	.5	.5	.7
Whooping cough	1.0	1.5	1.0	1.4	1.3
Diphtheria	.5	.4	.5	.6	.8
Influenza	1.8	2.4	5.2	11.2	10.4
Pneumonia (all forms)	19.4	19.7	32.9	37.7	43.0
Tuberculosis (all forms)	41.5	42.6	43.2	44.4	46.1
Tuberculosis of respiratory system	37.0	38.3	38.8	40.5	41.6
Syphilis	9.6	10.9	11.0	11.7	11.8
Cancer (all forms)	106.1	100.2	104.9	104.1	102.0
Diabetes mellitus	23.9	23.8	29.2	29.3	30.2
Cerebral hemorrhage	56.8	56.7	61.8	63.1	62.4
Diseases of the coronary arteries and angina pectoris	47.3	47.4	58.6	55.8	53.4
Other chronic heart diseases†	132.4	137.9	162.2	165.1	165.4
Diarrhea and enteritis	5.2	5.6	3.6	3.0	3.9
Appendicitis	6.2	8.6	5.7	7.7	8.9
Chronic nephritis	42.3	46.2	51.6	54.4	58.8
Puerperal state—total	4.4	5.4	4.4	4.6	4.7
Suicides	6.9	6.7	7.6	7.7	8.3
Homicides	3.3	4.6	3.7	3.6	3.4
Accidents—total	54.2	59.4	51.3	49.0	43.8
Home accidents	9.2	9.4	12.0	11.5	11.9
Motor vehicle accidents	15.0	21.0	17.9	19.6	15.9
War deaths	2.8	.1	4.2	.1	.2
All other causes of death	120.5	132.4	111.9	126.1	129.0

*The rates for 1942 are subject to slight correction, since they are based on provisional estimates of lives exposed to risk.

†International List (1940) titles 92, 93 (c), (d), (e), and 95.

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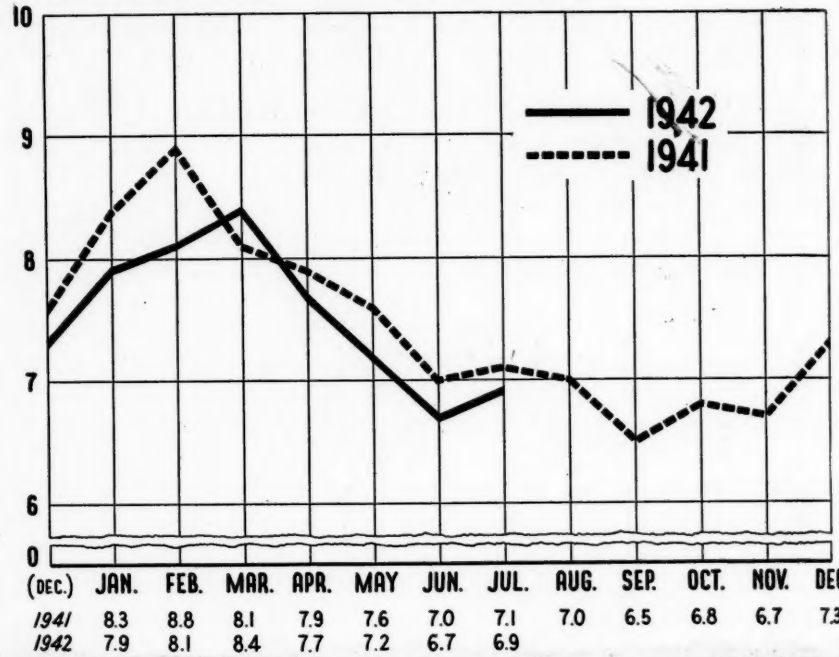
STATISTICAL BULLETIN
Metropolitan Life Insurance Company
1 Madison Avenue, New York, N. Y.

MORTALITY FROM ALL CAUSES

METROPOLITAN LIFE INSURANCE COMPANY
INDUSTRIAL DEPARTMENT, WEEKLY PREMIUM-PAYING BUSINESS

DEATH RATES PER 1,000 ANNUAL BASIS (*1942 figures are provisional*)



(DEC.)	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1941	8.3	8.8	8.1	7.9	7.6	7.0	7.1	7.0	6.5	6.8	6.7	7.3
1942	7.9	8.1	8.4	7.7	7.2	6.7	6.9					

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